INTI International College Penang

FINAL
Examination Paper

(COVER PAGE)

Session	:	**January 2020**
Programme	:	Diploma in Electrical & Electronic Engineering (DEEI)
Course	:	**EEE1106: Analogue Electronics**
Date of Examination	:	6 April 2020 (Monday)
Time	:	9.00am – 12.00pm Reading Time : Nil
Duration	:	Hours
Special Instructions	:	

This paper consists of **FOUR (4)** questions. Answer all the **FOUR (4)** questions. All question carry equal marks.

Materials permitted :

Nil

Materials provided :

Nil

Examiner(s)	:	**Mr Johnny Wong Kee Hui**
Moderator	:	Prof. Ir. Dr. Mandeep Singh

*This paper consists of **9** printed pages, including the cover page.*

INTI INTERNATIONAL COLLEGE PENANG
DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING PROGRAMME (DEEI)
EEE1106: ANALOGUE ELECTRONICS
FINAL EXAMINATION: JAN 2020 SESSION

Instructions: This paper consists of **FOUR (4)** questions. Answer **ALL** questions in the answer booklet provided. All questions carry equal marks.

Question 1

(a) Explain the function of coupling capacitor and bypass capacitor. (4 marks)

(b) Refer to the biasing circuit shown in Figure Q1 (b) with V_{BE} = 0.7 V,

(i) Determine the Q point of the circuit.

(4 marks)

(ii) Show the calculation on how voltage gain is affected if the bypass capacitor,C_E (emitter capacitor)is removed from the circuit. Discuss your finding.

(6 marks)

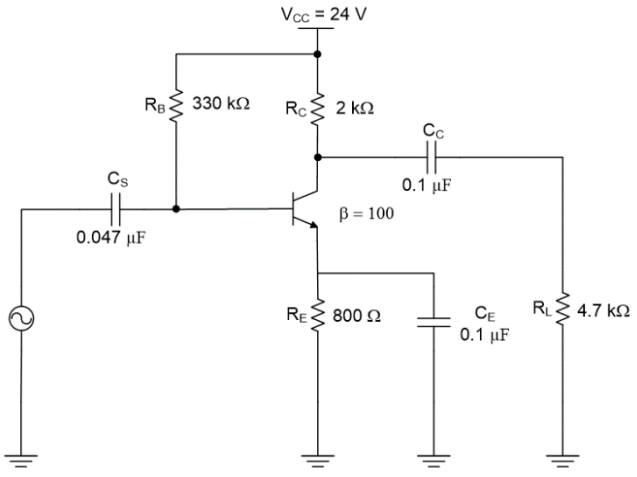

Figure Q1(b)

(c) Figure Q1 (c) shows a BJT (Bipolar Junction Transistor) based amplifier circuit. The transistor's β = 120. Calculate the voltage gain , A_V of the circuit.

(7 marks)

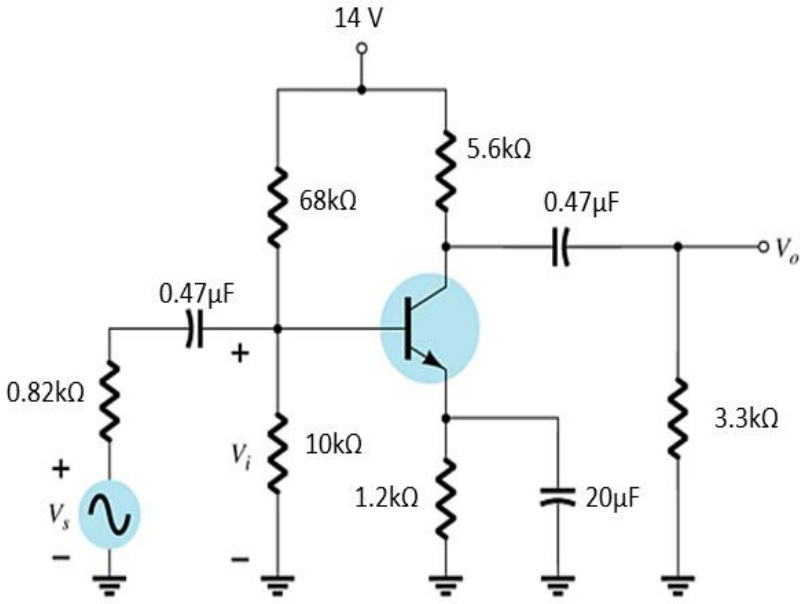

Figure Q1(c)

(d) Given the transfer characteristic for the enhancement-type MOSFET in Figure Q1 (d),

(i) Determine the constant value of *k*.

(2 marks)

(ii) Calculate the drain current, I_D when the gate-source voltage, V_{GS} = 6V.

(2 marks)

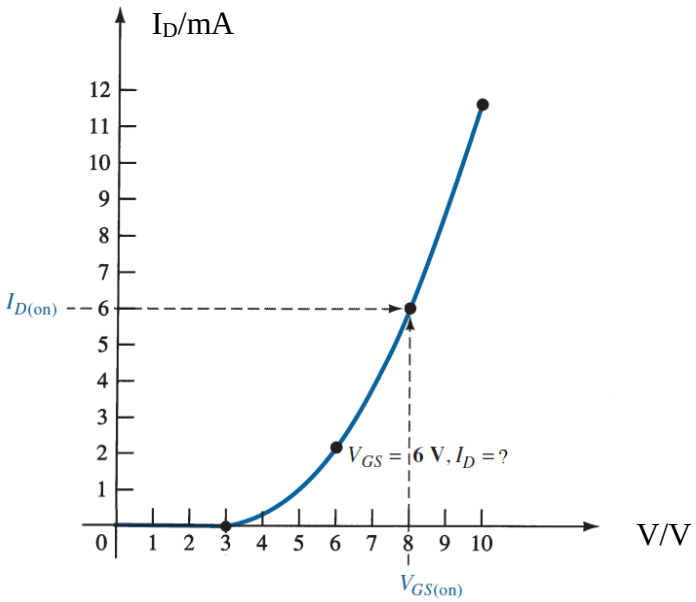

Figure Q1(d)

Question 2

(a) (i) State two advantages of negative feedback in op-amp circuit design. (2 marks)

(ii) In reality,the output of op-amp (V_o) has added error.List two factors and discuss accordingly. (2 marks)

(iii) Sketch the practical op-amp with proper labeling. (3 marks)

(b) Using a superposition method, determine the output voltage V_o in the ideal op – amp circuit shown in Figure Q2 (b). (6 marks)

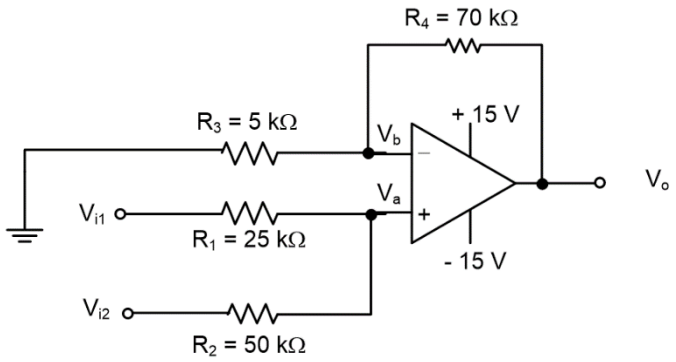

Figure Q2(b)

(c) Calculate V_o and i_o in the op-amp circuit shown in Figure Q2 (c). (4 marks)

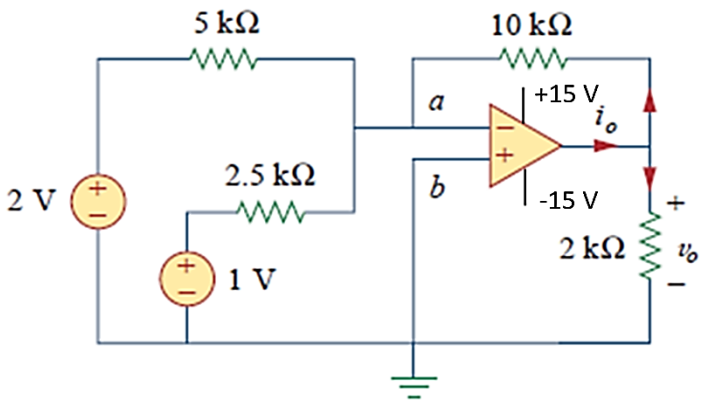

Figure Q2(c)

(d) For the circuit shown in Figure Q2 (d),

(i) Derive an expression for V_o in terms of V_{i1} and V_{i2}.

(3 marks)

(ii) Find V_o if $V_{i1} = (1 + 2 \sin[\omega t])$ mV and $V_{i2} = -10$ mV.

(2 marks)

(iii) Sketch the resulting output waveform for part (ii).

(3 marks)

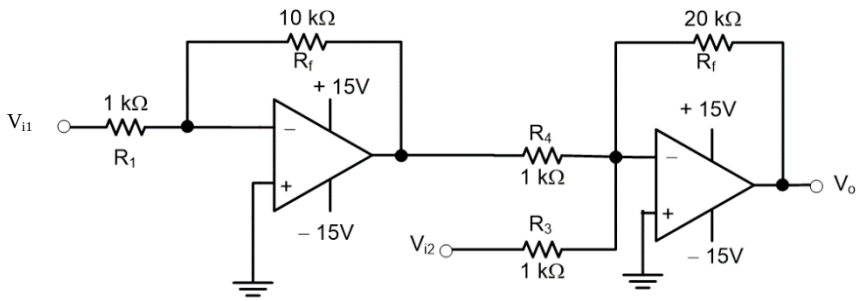

Figure Q2 (d)

Question 3

(a) For the RC network of Figure Q3(a),

(i) Determine the voltage transfer function.

(2 marks)

(ii) Calculate the attenuation (dB) at 100Hz.

(4 marks)

(iii) Sketch the asymptotes and locate -3dB point with corresponding cutoff frequency.

(2 marks)

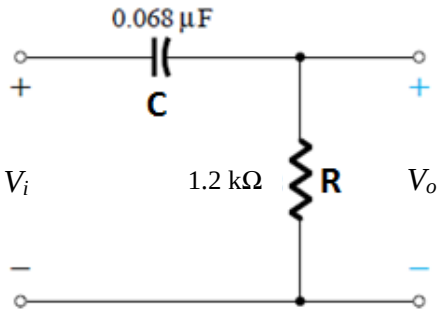

Figure Q3(a)

(b) Refer to the passive filter in Figure Q3 (b).

(i) Determine the transfer function, Vo/Vs.

(5 marks)

(ii) Calculate the critical frequency.

(2 marks)

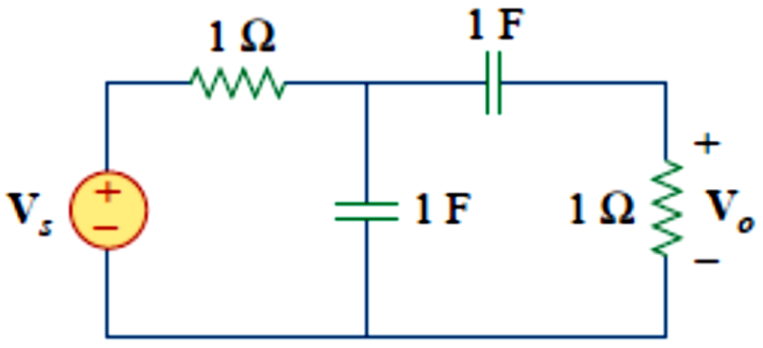

Figure Q3(b)

(c) Refer to the active filter in Figure Q3 (c),

(i) Calculate the critical frequency, f_c.

(2 marks)

(ii) Sketch the frequency response of the filter.

(2 marks)

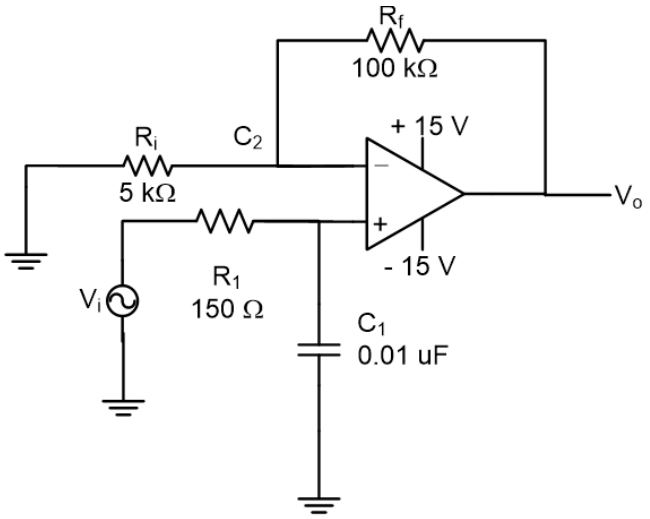

Figure Q3(c)

(d) Refer to the 2nd order active filter in Figure Q3 (d), show that the transfer function is given as :

$$\frac{v_{out}}{v_{in}} = \frac{s^2}{s^2 + 5000s + (12.5 \times 10^6)}$$

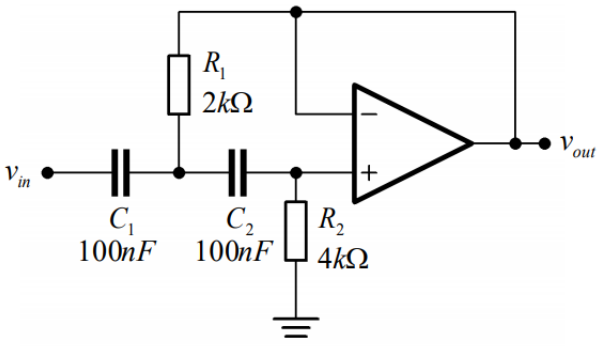

Figure Q3 (d)

(6 marks)

Question 4

(a) Distinguish the difference between a feedback oscillator and a relaxation oscillator.

(4 marks)

(b) (i) Draw a schematic diagram of a triangular wave generator using op-amps.

(2 marks)

(ii) Explain how to produce the desired triangular wave Use the circuit operation of the triangular wave generator in part (i).

(3 marks)

(c) Refer to the oscillator circuit in Figure Q4(c),

(i) Identify the oscillator type.

(2 marks)

(ii) If $R_1 = R_2 = 51$ kΩ and $C_1 = C_2 = 1$ nF, claculate the frequency generated by the circuit?

(3 marks)

(iii) State the relationship between R_3 and R_4 for the circuit to sustain oscillation and explain the reason for such relationship.

(3 marks)

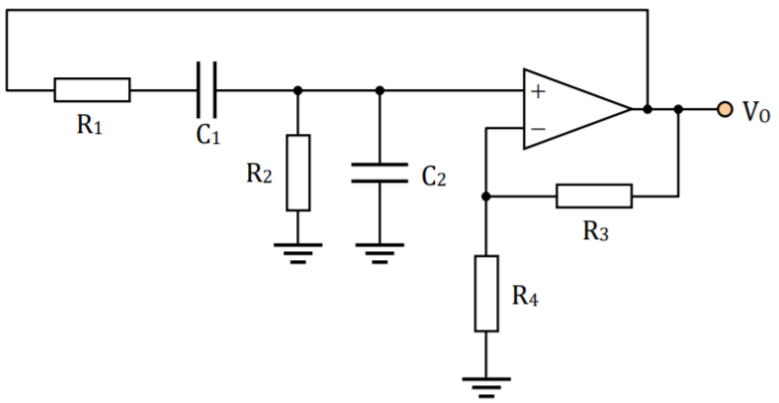

Figure Q4(c)

(d) Refer to the RC phase shift oscillator circuit in Figure Q4 (d),

(i) Determine the value of R_f necessary for the circuit to operate as an oscillator.

(3 marks)

(ii) Determine the frequency of oscillation.

(2 marks)

(iii) When considering the operation of the feedback network, one might naively select the values of R and C to provide 60°phase shift per section for three sections,resulting in 180° phase shift, as desired. However, it is not the case. Explain the reason and how to improve this.

(3 marks)

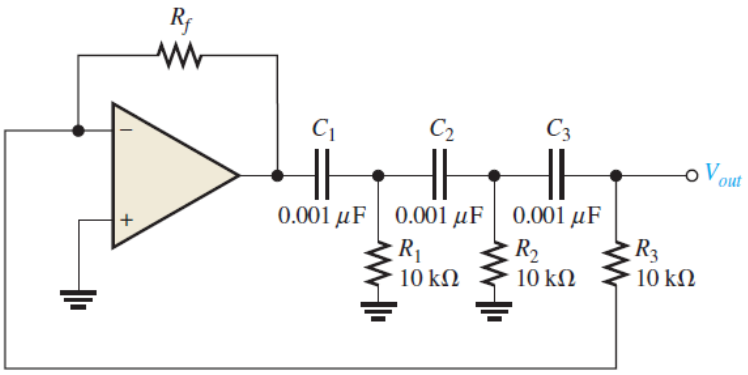

Figure Q4(d)

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